

## CLAIMS

1. A butadiene-based polymer having a 1,3-butadiene monomer unit, characterized in that a cis-1,4 bond content and a vinyl bond content in the 1,3-butadiene monomer unit as measured by a Fourier transform infrared spectroscopy (FT-IR) is not less than 98.0% and not more than 0.3%, respectively, and a ratio (Mw/Mn) of weight average molecular weight (Mw) to number average molecular weight (Mn) is 1.6-3.5.

2. A butadiene-based polymer according to claim 1, wherein the cis-1,4 bond content and the vinyl bond content satisfy a relationship of the following equation (I):

$$(\text{vinyl bond content}) \leq 0.25 \times ((\text{cis-1,4 bond content}) - 97) (\%) \cdots \cdots (I)$$

3. A butadiene-based polymer according to claim 1, wherein the ratio (Mw/Mn) of weight average molecular weight (Mw) to number average molecular weight (Mn) is 1.6-2.7.

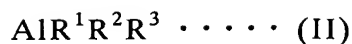
4. A butadiene-based polymer according to claim 1, wherein the polymer consists of 80-100% by mass of 1,3-butadiene monomer unit and 20-0% by mass of the other monomer unit capable of copolymerizing with 1,3-butadiene.

5. A butadiene-based polymer according to claim 4, wherein the polymer is made of only 1,3-butadiene monomer unit.

6. A butadiene-based polymer according to claim 1, wherein the number average molecular weight (Mn) is 100,000-500,000.

7. A butadiene-based polymer according to claim 6, wherein the number average molecular weight (Mn) is 150,000-300,000.

8. A method of producing a butadiene-based polymer, characterized in that monomers at least containing 1,3-butadiene is polymerized at a temperature of not higher than 25°C in the presence of a catalyst system comprising (A) component: a compound containing a rare earth element of Atomic Number 57-71 in the Periodic Table or a reaction product of such a compound with a Lewis base; (B) component: an organoaluminum compound represented by the following general formula (II):



(wherein  $\text{R}^1$  and  $\text{R}^2$  are the same or different and are hydrocarbon group having a carbon number of 1-10 or a hydrogen atom, and  $\text{R}^3$  is a hydrocarbon group having a carbon number of 1-10 provided that  $\text{R}^3$  may be the same as or different from  $\text{R}^1$  or  $\text{R}^2$ ); and  
(C) component: at least one of Lewis acid, a complex compound of a metal halogen compound and Lewis base and an organic compound containing an active halogen.

9. A method of producing a butadiene-based polymer according to claim 8, wherein the rare earth element containing compound in the component (A) is a salt of neodymium soluble in a hydrocarbon solvent.

10. A method of producing a butadiene-based polymer according to claim 9, wherein the rare earth element containing compound in the component (A) is a branched carboxylate of neodymium or a reaction product of such a salt with a Lewis base.

11. A method of producing a butadiene-based polymer according to claim 8, wherein the catalyst system further contains (D) component: an aluminoxane.

12. A method of producing a butadiene-based polymer according to claim 11, wherein the catalyst system is previously prepared in the presence of component (A), component (B), component (C), component (D) and a conjugated diene monomer.

13. A rubber composition, characterized in that a rubber component contains not less than 10% by mass of a butadiene-based polymer as claimed in any one of claims 1 to 7.

14. A rubber composition according to claim 13, wherein less than 10 parts by mass of a filler is compounded based on 100 parts by mass of the rubber component.

15. A rubber composition according to claim 14, wherein the rubber composition is sulfur crosslinkable.

16. A tire, characterized in that a rubber composition as claimed in any one of claims 13 to 15 is used in any member of the tire.